Name: KEY

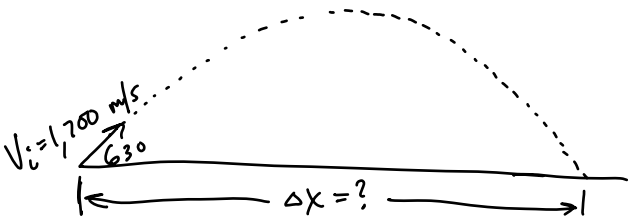
Date:

Section C D F

The Masters School
Mr. Alex Rawson
Physics

Projectile Motion II - Angled

1. A ball is fired from the ground with an initial speed of 1.70 ×10^3 m/s (approximately five times the speed of sound) at an initial angle of 63.0° to the horizontal. Neglect air resistance.
   a. Find the ball's horizontal range.



$\Delta x = 238{,}401$ $\Delta y = 0$
$V_{ix} = 772$ $V_{iy} = 1515$
$V_{fx} = 772$ $V_{fy} =$
$a = 0$ $a = 9.81\ m/s^2$
Δt = $\Delta t = 309\ s$

$\Delta y = (V_i \sin\theta)\Delta t - \frac{1}{2} g \Delta t^2$

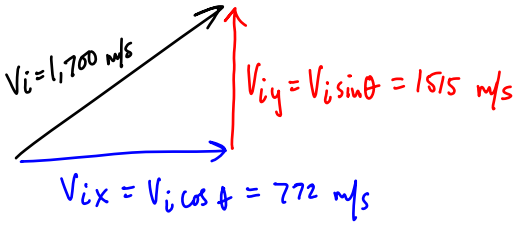
$0 = 1515\,\Delta t - (4.905)\Delta t^2$

$4.905\,\Delta t^2 = 1515\,\Delta t$

$4.905\,\Delta t = 1515$

$\Delta t = 309\ s$

   b. Find the amount of time the ball is in motion.

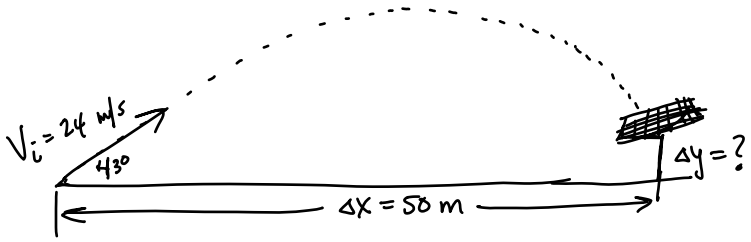


$\Delta x = V_x\,\Delta t$

$\Delta x = (772)(309)$

$\Delta x = 238{,}401$ m

2. A daredevil is shot out of a cannon at 43.0° to the horizontal with an initial speed of 24.0 m/s. A net is positioned a horizontal distance of 50.0 m from the cannon. At what height above the cannon should the net be placed in order to catch the daredevil?



$\Delta x = 50$ m Δy = ?
$V_{ix} = 17.55$ $V_{iy} = 16.37$
$V_{fx} = 17.55$ $V_{fy} = 16.37$
a = $a = 9.81\ m/s^2$
Δt = Δt =

$\Delta x = V_x\,\Delta t$

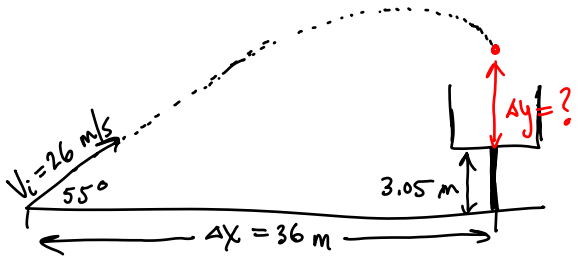
$\Delta t = \frac{\Delta x}{V_x} = \frac{50}{17.55}$

$\Delta t = 2.85$ sec

$\Delta y = V_i \sin\theta\,\Delta t - \frac{1}{2} g \Delta t^2$

$\Delta y = 6.808$ m

3. A place kicker must kick a football from a point 36.0 m (about 40.0 yd) from the goal, and the ball must clear the crossbar, which is 3.05 m high. When kicked, the ball leaves the ground with a speed of 26.0 m/s at an angle of 55° to the horizontal.
   a. By how much does the ball clear the crossbar?



$\Delta x = 36$ m $\Delta y = ?$
$V_{ix} = 14.91$ $V_{iy} = 21.30$
$V_{fx} = 14.91$ $V_{fy} =$
$a = 0$ $a = 9.81$
$\Delta t =$ $\Delta t =$

$\Delta x = V_x \Delta t$

$\Delta t = 2.414$ sec

$\Delta y = V_i \sin\theta \, \Delta t - \frac{1}{2} g \Delta t^2$

$\Delta y = (21.3)\Delta t - 4.905 \Delta t^2$

$\Delta y = 22.83$ m

$\Delta y - 3.05$ m $= 19.78$ m

   b. Does the ball approach the crossbar while still rising or while falling? (Hint: If Vf,y is positive, the ball is still rising, if Vf,y is negative, the ball is falling)

$V_{fy} = V_i \sin\theta - g\Delta t$

$V_{fy} = 21.30 - (9.81)(2.414)$

$V_{fy} = -2.38$ m/s (falling)

   c. What is the vertical component of velocity of the ball at this time?